Yarmouk University
Faculty of Economic and Administrative Sciences
Department of Banking and Finance

"A Study of Bank Efficiency: An Empirical Study of Commercial Banks in Jordan using a DEA during the Period 2005-2009 ".

"دراسة كفاءة البنوك: دراسة تطبيقية على البنوك التجارية الأردنية باستخدام طريقة تحليل تغليف البيانات خلال الفترة 2005-2009"

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Submitted in Partial Fulfillment of Requirements for the degree of Master of Finance & Banking Sciences at Yarmouk University, Irbid, Jordan.

July, 2010

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Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Finance & Banking Sciences at Yarmouk University.

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July, 2010

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Dedication

To my Beloved Parents

To my Brothers

To my Sisters

And to all my Friends

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First and foremost, I am sincerely grateful to my thesis supervisor **Dr. Abeer Al-khoury** for her time, encouragement, and for her comments.

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Muneer Zakarneh

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Abstract

This study aims to measure the level of efficiency of Jordanian banks for the period from 2005 to 2009 by applying a non-parametric technique called Data Envelopment Analysis (DEA) methodology. In specific, Charnes, Copper and Rhods (CCR) model with Constant Return to Scale (CRS) approach under output maximization assumption with intermediation approach was used in this study. The six criteria of banking sector which divided into three inputs (credit risks, liquidity risks and interest rate risks) and three outputs (Direct credit facilities, net interest income and investment income), were used in this study. Ranking model was used to rank Jordanian banks according to its relative efficiency and Tobit regression was used to identify to what extent that a certain input or output variables for a specific DMU affected on the efficiency score. The results of this study revealed that a number of Jordanian banks was presented efficiency over the period of this study except in year 2008 because the global economic crisis that affected on the Jordanian banking sector in this year. Tobit regression analysis indicated that all outputs variables were associated with Jordanian banks efficiency. On the other hand, this analysis indicated that interest rate risks variable was not associated with Jordanian banks efficiency.

Keywords: Efficiency, Jordanian Banks, DEA.

Chapter One: Introduction

1.1 Preface

Evaluating banking efficiency has been a common practice among many banking and finance researchers for a number of years. The main reason for continued interest in this area of research is the changing banking business environment.

The commercial banks represent an important sector in the national economy and play a safer intermediary between savers and investors in terms of deposit of the funds and reinvest it. So the process of efficiency evaluation is a task to be accomplished in order to improve and enhance the efficiency of the financial and banking operations to ensure the continuation of strength enough to compete between banks (Kuo *et al.* 2008).

The primary goal for banks is to pursuit maximum profit, but high profit accompanies high risk. Therefore, banks must find an optimal position between risk and return.

In general, the risks which banks have to face are credit risk, interest rate risk, market risk, liquidity risk, foreign exchange risk and solvency risk. So, characterizing and construct of risk-return relationship are important issues in risk-driven processes of bank risk management (Kuo *et al.* 2008).

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1.2 Objectives of the Study

The main objective of this study is to evaluate the efficiency of Jordanian banks during the period 2005 to 2009. At the same time, banking environment in Jordan became more competitive and increased the need for evaluating the efficiency of commercial banks in Jordan.

The specific objectives of the study are:

* To determine the level of efficiency of the commercial banks operating in Jordan.
* To examine the influence of different factors on Jordanian bank's efficiency.

1.3 Importance of the Study

The knowledge of evaluating of commercial bank's efficiency in Jordan is very important to know how efficient are Jordanian banks and to what level.

The results of this study can be used by bank's managers to identify the efficient banks in Jordan and make these banks as benchmark to improve the performance of their banks.

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1.4 Problem of the Study

The problems of this study appear in the following questions:

1. What is the impact of the global economic crisis on the level of efficiency of Jordanian banks during the period 2005 to 2009?

2. What is the impact of credit risks, liquidity risks and interest rate risks on the efficiency of Jordanian banks during the period of this study?
3. what is the impact of direct credit facilities, net interest income and investment income on the efficiency of Jordanian banks during the period of this study?

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1.5 Hypotheses of the Study

To achieve the objectives of the study and to answer its questions, the following hypotheses are adopted:

H1: There is no impact in the efficiency levels of Jordanian banks by the global economic crisis during the period under the study.

H2: Credit risks, liquidity risks and interest rate risks have no impact on the efficiency of Jordanian banks.

H3: Direct credit facilities, net interest income and investment income have no impact on the efficiency of Jordanian banks.

1.6 Population of the study

The population of this study includes the commercial banks in Jordan during the period 2005 to 2009, while this study excluded Islamic banks and foreign banks operating in Jordan because of major differences in services offered, operating structure and environment (Salhieh and Abu-Doleh,2004).

Only 13 banks were actually included in this study which covered data from their published annual reports for the period 2005 to 2009.

1.7 Data and Methodology

The published financial statements (balance sheets and income statements) data of Jordanian banks that will be used in this study from December 2005 to December 2009, to provide information which will measure efficiency of the banks in general and is not to comment on any bank in particular.

The material of this study were collected from journal articles and electronic articles that are related to the subject of the study which help in hypotheses modeling and analyzing data.

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To be able to measure the efficiency of banks in Jordan, a non-parametric technique called Data Envelopment Analysis (DEA) was applied in this study.

1.8 Structure of the Study

This study is divided into six chapters. Chapter one presents introduction, chapter two presents theoretical framework, chapter three presents literature review, chapter four presents methodology, chapter five presents data analysis and chapter six presents conclusions and recommendations.

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Chapter Two: Theoretical Framework

2.1 Efficiency Definition

In general, the efficiency analysis of a production or service unit refers to the comparison between the outputs and inputs used in the process of producing services (Mokhtar *et al.* 2006). Efficiency measurement is one aspect of a firm's performance; efficiency can be measured with respect to maximization of output, minimization of cost or maximization of profits.

According to Kumbhakar and Lovell (2003), efficiency is divided into two components, technical efficiency and alloctative efficiency. Technical efficiency refers to effective utilization of production factors, i.e. maximum outputs from given inputs or minimize inputs used in the production of given outputs. The objective of producers here is to avoid waste. On the other hand, allocative efficiency relates to the optimal combination of inputs and outputs at a given price. The objective of producers might entail the production of given outputs at minimum costs or the utilization of given inputs to maximize the revenue, or the allocation of inputs and outputs to maximize profit.

There are two general methodologies that are commonly used to measure efficiency. They are: parametric approach using econometric techniques, and non-parametric approach utilizing linear programming method. Both differ mainly in how they handle

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the random error and their assumptions regarding the shape of the efficient frontier. Each of the techniques has its own strengths and weaknesses (Berger and Humphery, 1997).

The parametric approach has the advantage of allowing noise in the measurement of inefficiency. However, the approach needs to specify the functional from for the production, cost or profit function. Common parametric methods are the Stochastic Frontier Approach (SFA), the Thick Frontier Approach (TFA) and the Distribution Free Approach (DFA) (Berger and Humphrey, 1997).

Non-parametric approach is simple and easy to calculate since it does not require specification of functional form (Coelli, 2004). However, it suffers from the drawback that all deviation from the best-practice frontier is attributed to inefficiency since it does not allow for noise to be taken into account. The common non-parametric techniques are the Free Disposal Hull analysis (FDH) and the Data Envelopment Analysis (DEA) (Mokhtar *et al.* 2006).

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2.2 Banking Efficiency

Efficiency of a commercial bank is often used to describe its performance. The measured efficiency of a commercial bank is usually used to interpret the difference between the observed quantity of input and output variables with respect to optimal quantity of input and output variables. This optimal quantity is that possible combination of input and output variables that can be

obtained by a bank under maximization of outputs (output oriented) from used inputs or minimization of inputs (input oriented) to produce obtained output (Wheelock and Wilson, 1999). The maximum value which a fully efficient bank can obtain is one (100%) while the minimum value which the most inefficient bank can have is zero (0%). Obviously, efficiency measures do not take negative values, as banks cannot waste more than 100% of their factor inputs. For example, if a commercial bank obtains value 0.90 it means that the bank under study in 90% efficient to convert inputs to outputs or bank can produce some level of output even by utilizing 10% less of current level of inputs (Wheelocak and Wilson, 1999).

The term "efficiency" is a relative concept. For example, the efficiency of a bank in 1996 could be measured relative to 1990 efficiency or it could be measured relative to the efficiency of another bank in 1996. Efficiency of commercial banks should be measured against a specific objective. For example, efficiency of a commercial bank can be measured in terms of minimization of inputs to produce specific level of outputs, minimization of costs to produce specific level of outputs, minimization of expenditures to achieve given level of revenues, minimization of inputs to produce specific level of profits (Mester, 1996).

Efficiency measurement of commercial banks under a specific objective is an indicator of success by which the performance of commercial banks can be compared with each other and efficiency

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estimates of commercial banks are also indicators of government policies impact on banks (Wheelock and Wilson, 1999).

2.3 Efficiency Frontier

According to Chansarn (2008), the positions on the figure (2-1) represented by Bank A (point A) and Bank C (point C) demonstrate a level of performance which is superior to all other banks. A horizontal line can be drawn from the Y-axis to point A, from point A to point C, and a vertical line from point C to X-axis. This is called the efficiency frontier. It defines the maximum combinations of outputs that can be produced for a given set of inputs.

The efficiency frontier, derived from the examples of the best practice contained in the data we have considered, represents a standard of performance that the banks not on the efficiency frontier could try to achieve (Chansarn, 2008).

According to the figure (2-1), it is very easy to interpret. Any banks on the efficiency frontier are 100% efficient (have an efficiency score of 1.00 or 100%). Thus, for our example, Bank A and Bank C have efficiencies of 100%.

Since Bank B and Bank D lie below the efficiency frontier, they are inefficient (have an efficiency score of less than 1.00 or

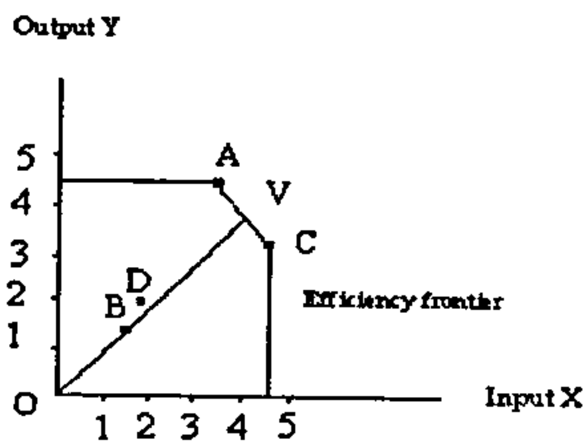
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100%). Their efficiencies can be determined by comparing them to the virtual bank formed from Bank A and Bank C.

Let's consider the efficiency of Bank B. the virtual bank (point V) is the best possible performance that Bank B could be expected to achieve. This is the point where the line from the origin through Bank B (point B) meets the efficiency frontier. In other word, the virtual bank (point V) represents a bank that, was to exist, would have the same business mix as Bank B and would be 100% efficient.

The efficiency of Bank B is then calculated by finding the fraction of inputs that the virtual bank (Point V) would need to produce as many outputs as Bank B. This is easily calculated by looking at the line from the origin, O, to V. the efficiency of Bank B can be measure as OB/OV. Note here that OB is the output which Bank B can produce; whereas OV is the maximum output which can be produced with the same amount of input as bank B.

Figure (2-1): Efficiency frontier



Source: Chansarn (2008), page 56

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2.4 Data Envelopment Analysis (DEA)

Data Envelopment Analysis (DEA) is widely used technique for the measurement of the relative performance of the banks. DEA is specific methodology for analyzing the relative efficiency for multiple inputs and outputs by evaluation of all decision-making units (DMUs) and measurement of their performance in respect to the best practice banks which determine the efficient frontier (Berger and Humphrey, 1997). The DMUs could be banks or branches of banks. In DEA, the frontier is estimated by using mathematical method i.e. linear programming and this estimated frontier is used to measure the relative performance of the banks. As DEA is a non-parametric technique, it does not require any structural form of the production frontier (Wheelock and Wilson, 1999).

DEA is a non-parametric approach that assumes that all deviations from the frontier are inefficiencies without any prior assumptions. The aim of DEA is to estimate relative efficiency among similar decision units that have the same technology (processing procedure) to pursue similar objectives (outputs) by using similar resources (inputs) (Resti, 1997).

The main advantages of DEA are that, first, it does not require a prior assumption about the analytical form of the production function, and second, capable of handing multiple inputs and outputs. At the same time, DEA also has some disadvantages. First,

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it is sensitive to the selection of inputs and outputs, and second, the number of efficient banks on the frontier tends to increase with the number of inputs and output variables (Berger and Humphrey, 1997).

There are various models of DEA, and these are CCR model and BCC model. CCR model was developed by Charnes, Cooper and Rhodes (Charnes *et al.* 1978). Its specific assumption is that the DMU operates under constant returns to scale (CRS). BCC model was defined by Banker, Charnes and Cooper (Banker *et al.* 1984). It estimates the efficiency under the assumption of variable returns to scale (VRS).

In addition to the specification of the used DEA-model it is necessary to determine the factors, which will be used as measures of inputs and outputs. Depending on the data availability and economic treatment of banking institutions as producers of financial services or mediators of funds between savers and investors, several approaches to DEA have been used. The two main approaches to DEA are: the production approach; and, the intermediation approach (Nenovsky *et al.* 2007).

The production approach defines the bank activity as production of services and views the banks as using physical inputs such as labors and capital to provide deposit and loan accounts. While the intermediation approach views banks as the intermediate

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of financial services and assumes that banks collect deposits, using labors and capital, then intermediate those sources of funds into loans and other earning assets. This intermediation approach is argued to be particularly appropriate for banks where most activities consist of turning large deposits and funds purchased from other financial institutions into loans or financing and investments (Mokhtar *et al.* 2006).

In this study, it is decided to use the intermediation approach, as it is in line with the specific treatment of Jordanian banks behavior and fit very well to the available individual banks data.

2.5 DEA Technique

Efficiency measurement investigates how organizations employ their own resources in order to estimate one's productivity for the purpose of appraisal and improvement. Traditionally, ways to evaluate organization's productivity have different norms and attributes, thus, it is not easy to measure efficiency on the same criteria. Farrell (1957) proposed that the economic efficiency of a firm is a combination of its technical efficiency, which reflects its ability to obtain the maximal outputs from a given set of inputs, and its allocative efficiency, which reflects its ability to use inputs in optimal proportions given their respective prices. To calculate these frontiers numerically, a technique called "Data Envelopment Analysis" or DEA, for short, must be used.

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From its very outset (Charnes, Cooper, and Rhodes, CCR, 1978) Data Envelopment Analysis (DEA) had enjoyed a high number and a high incidence of real-world applications. For example, evaluate and compare educational departments, health care, agricultural production, banking, armed forces, sports, market research, transportation and many other applications. As a non-parametric technique, DEA is firmly based on linear programming to calculate the relative performance of efficiency for a finite number of decision making units (DMUs) such as, commercial banks.

Farrell (1957) proposes first to identify an assumed existing efficient frontier using the production function. Then deviations from the efficient frontier have a natural interpretation as a measure of inefficiency with which economic units, or firms, pursue their technical or behavioral objectives. According to Farrell (1957), DMUs which are efficient would locate on the efficient frontier, and their rating values equal to 1, as for inefficient DMUs, they would within the frontier, and rating values would lie in between 0 and 1.

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Chapter Three: Literature Review

3.1 Introduction

This chapter briefly discusses some literature that applied Data Envelopment Analysis (DEA) methodology in banking sector. It contains two sections. Section one presents related literature review in the banking sector and section two presents what distinguishing this study from previous studies.

3.2 Related Literature Review in the Banking Sector

Banks play an important role in the financial markets of the developing countries and it is very important to evaluate whether banks operate efficiently or not.

For financial institutions, efficiency implies improved profitability, greater amount of funds channeled in, better prices and services quality for consumers and greater safety in terms of improved capital buffer in absorbing risk (Berger and Humphrey, 1997).

There are many research studies that try to look into the efficiency of banks operating within a country and across the countries. These studies can be differentiated on the basis of used

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Al-Faraj *et al.* (1993) evaluated the relative efficiency of bank branches of the largest commercial bank in Saudi Arabia by means of DEA for the improvement of the utilization of available resources at branch level more efficiently. They applied DEA methodology on fifteen branches of the bank located in the eastern province of Saudi Arabia. One year actual input-output data of the bank was used for the study. Eight inputs and seven output factors were identified at branch level on the basis of consultation and personal interviews with the administrators of the several banks. DEA enabled them to identify three inefficient branches out of the fifteen branches under consideration.

English *et al.* (1993) assessed output efficiency of individual banks than the estimation of technical and allocative input efficiency of banks in United States by using non-parametric frontier approach. Their technique focused on revenues. For outputs, they included real estate loans, commercial loans, consumer installment loans, and investment in U.S securities. Interest bearing small deposits (less than $100,000), labor, occupancy expenses and purchased or borrowed fund (greater than $100,000) were used as inputs. They found that, on average, the banks in their sample were technically inefficient. Also they determined that the banks with greater assets were technically more efficient than those with relatively less assets and banks on the average were allocatively inefficient i.e. output mix of banks is not revenue maximizing at existing prices.

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and banks on the average were allocatively inefficient i.e. output mix of banks is not revenue maximizing at existing prices.

Miller and Noulas (1996) used DEA to estimate the technical efficiency of 201 large sized banks operating in United States. For this estimation, represented inputs by total transactions deposits, total non-transactions deposits, total interest expense and total non-interest expense, and outputs by commercial and industrial loans, consumer loans, real estate loans, investments, total interest income and total non-interest income, of the banks from 1984 to 1990. They estimated overall technical, pure technical and scale efficiency for the banks and found large mean estimated scores of scale efficiency as compared to overall technical and pure technical efficiency scores. They also found that the pure technical inefficiency was twice as compared to scale inefficiency and also reported the number of banks operating under decreasing returns to scale, increasing returns to scale and constant returns to scale. They found that the profitability and size (measured by total assets) of the banks were significant contributors to overall technical efficiency.

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Resti (1997) used econometric and DEA technique to analyze a panel of 270 Italian banks. He used loans, deposits and non-interest income as outputs while labor and capital as inputs. The results show that econometric and DEA estimated efficiency scores are the same under the same conceptual framework data. But, if differences present between the estimated efficiency scores, it can be explained by describing the basic features of the models. In Italian

banking sector, he found a high variance in efficiency scores and direct relationship between productive efficiency and quality of assets. He could not find any evidence of efficiency improvement over the period 1988-1992.

Ayadi *et al.* (1998) measured bank performance in Nigeria by applying DEA to ten banks by using financial data from 1991 to 1994. They used interest paid on deposits, total expenses and total deposits as inputs while total loans, interest and non-interest income were considered as outputs. They reported that banks existence for long period of time are relatively efficient than other banks in the sample, and banks having poor management showed bad performance and this is a key determinant of the bad performance banks in Nigeria.

Jackson and Fethi (2000) analyzed performance of Turkish banking sector by applying DEA and then explored the determinants of efficiency from a set of explanatory variables (bank size, number of branches, profitability, ownership and capital adequacy ratio) by the use of Tobit model. They defined performance of a bank in terms of its ability to produce outputs with minimum use of inputs. They used the data of the year 1998 and considered number of employees and sum of non labor expenses as inputs of the bank while loans, demand deposits and time deposits were considered as outputs of the bank. The results of this study showed that larger and more profitable banks were more likely to operate at higher levels of technical efficiency, and that the capital adequacy ratio had a

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Saha and Ravisanker (2000) analyzed the bank efficiency in India using the DEA methodology. Four input variables (number of branches, number of employees, establishment expenditure, non-establishment expenditure (excluding interest expenditure)), and eight output variables (deposits, advances, investments, spread, total income, interest income, non-interest income and working funds) were used in the study to evaluate the efficiency levels of banks. The sample includes 25 banks and the test period was from 1992 to 1995. The results of the study indicated that the public sector banks in general have improved their efficiency scores over the years 1992 to 1995.

Isik and Hassan (2002) estimated cost alloctative, technical, pure technical and scale efficiency of Turkish banking industry from 1988 to 1996 by using DEA. Following intermediation approach, they considered labor, capital and loanable funds as inputs of the bank and short term loans, long term loans, risk adjusted off-balance sheet items and other earning assets as outputs of the bank. They found that the state and foreign owned banks performed better than the private domestic banks. They also found that a positive impact of ratio of loans to total assets on the efficiency level of the Turkish banks. Thus, government should promote competition in banking sector by enforcing financial reforms to improve the efficiency of all banks.

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Sathye (2003) measured the productive efficiency of Indian banks. He used input oriented model of DEA under the assumption of variable return to scale. Indian banks association published data of year 1997-1998 were used for the study. He used two models to calculate the efficiency scores of public, private and foreign owned banks. In one model, he used interest expenses and non-interest income as output of the bank. In the second model, he used deposits and staff number as inputs. The model estimated mean efficiency score is 0.83 while in second model it is 0.62. He found that most foreign owned banks on the estimated frontier. He also found that the efficiency scores of private owned banks were lower as compared to public owned and foreign owned banks. He explained the result by the fact that lower score of private sector banks could be due to their expansion.

Das *et al.* (2004) analyzed the efficiency of Indian banks using DEA, using four input measures (borrowed funds i.e. deposits and other borrowings, number of employees, fixed assets and equity), and three output measures (investments, performing loan assets and other non-interest free based incomes). They found that Indian banks were still not much differentiated in terms of input-or output-oriented technical efficiency and cost efficiency. However, they found that there were significant differences in terms of revenue and profit efficiencies. They also found that bank size, ownership, and the fact of its being listed on the stock exchange had a positive impact on the average profit efficiency and to some extent revenue

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efficiency scores. Also, they found that there was a general improvement in efficiency during the post–reform period.

Kao and Liu (2004) used DEA methodology as a tool for evaluating past accomplishments in the banking industry in Taiwan. Three input and three output variables were used: total deposits, interest expenses, and non-interest expenses (inputs) and total loans, interest income, and non-interest income (outputs). The sample consisted of 24 commercial banks in Taiwan. The main findings were that all efficiency scores calculated from the data contained in the financial statements published afterwards fall within the corresponding predicted ranges of the efficiency scores which calculated from the financial forecasts. In other words, the efficiency scores calculated from the financial statements fall within the efficiency scores calculated from the financial forecasts.

Maghyereh (2004) estimated the efficiency of Jordanian banking sector after 1990s financial liberalization by using DEA. He used data of eight commercial banks from 1984 to 2001. He considered three inputs (number of employees, value of fixed assets and deposits) and three outputs (loans and liquid assets, investment and other income) of the bank by employing intermediation approach. The range of yearly estimated average DEA technical and pure technical efficiency score of all banks for his study was 0.847 to 0.987 and for scale efficiency was from 0.903 to 0.999. After efficiency estimation, he used Tobit model to determine the impact of important factors. From analysis he found positive impact of size,

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profitability, market power of the bank and financial liberalization on the efficiency of commercial banks.

Salhieh and Abu-Doleh (2004) used DEA methodology to measure the efficiency of Jordanian's banks over the period 1994 to 2000. Three inputs and four outputs were used: staff expenses, fixed assets and premises, Loan-able funds (inputs), and credit facilities, investment, interest income of balance sheet items (outputs). The sample consisted of 12 banks. The unique slacks (excess inputs) for the inefficient banks provided management with marginal values relative to efficient frontier that can assist management in locating resources over the usual variety of income banks activities and the magnitude of the inefficiency is given by the magnitude of excess resources used (input-orientation) by the inefficient bank. The results revealed that an overall improvement is evident in banking industry in Jordan from 84.10 per cent in 1994 to 94.52 per cent in 2000. They also claimed that the improvement in efficiency was due to consciousness of the banking industry toward the challenge that are facing them in the near future.

Havrylchyk (2006) estimated cost, allocative, technical, pure technical and scale efficiency of Polish banking industry by using DEA. He used data from 1997 to 2001 with loans, government bonds and off-balance sheet items as outputs and capital, labor and deposits as inputs of the bank. He found that foreign banks were significantly more cost efficient as compared to domestic banks and in the period under consideration, efficiency of banks on average is

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deteriorated. In order to investigate the determinants of cost, technical and allocative efficiency, he used Tobit model. Also he found that takeover had negative effect on the efficiency of banks while state ownership and assets of the banks had positive impact on the efficiency of bank.

Kirkwood and Nahm (2006) evaluated the banking service efficiency and profit efficiency of Australian banks by using DEA. For the analysis, data of 10 listed banks on Australian Stock Exchange from 1995 to 2002 were used. In order to evaluate the banking service efficiency, interest bearing assets and non-interest income were used as outputs, while number of full time employees, interest bearing liabilities, property, plant and equipment were used as inputs of the bank. For the evaluation of profit efficiency, the same inputs which were used in banking service efficiency were considered as inputs of the bank, while profit before tax and abnormal items was considered as output of the bank. Their results indicated an improvement in the efficiency of major banks in production banking services and profits while regional banks showed decline in the efficiency regarding the production of profits and little change regarding the production of banking services. After the estimation of efficiency, they related the efficiency change with stock returns.

Moh'd. *et al.* (2006) investigated the change in the productivity of banking industry during the period of 2000 to 2004 of 11 commercial banks in Malaysia. Productivity was measured by the

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Malmquist index, using DEA technique. The Malmquist productivity measures are decomposed into two components, efficiency change and technical change index. Three inputs and outputs are utilized to investigate efficiency of 11 commercial banks of Malaysia. The inputs are total deposits, personal expenses, and capital expenses, while the outputs are loans and advances, capital market investments, and money market investments. Overall, the results obtained from this study show that total factor productivity (TFP) has slightly increased for the whole industry in which efficiency change was found to be the most important source of productivity growth to Malaysia's banking industry as compared to technical component that contributes a negative change to the overall TFP growth.

Pasiouras (2006) estimated the technical and scale efficiency of Greek commercial banks by using data of these banks from 2000 to 2004. For efficiency estimation, he used DEA and proposed five models. Four models were based on the intermediation approach while one was based on the profit orientation approach. In the models under intermediation approach, fixed assets, number of employees, loan loss provisions, customer deposits and short-term funding were considered as inputs while loans, off-balance items and other earning assets were considered as outputs of the bank. In the model under profit oriented approach, he used employees' expenses, other non-interest expenses and loan loss provisions as inputs while net interest income, net commission income and other operating income as outputs of the bank. To explain the efficiency of banks, he

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used Tobit model. He found significant positive impact of equity to assets, loans to assets and assets of the bank on the estimated efficiency of banks.

Bdour and Al-khoury (2008) used DEA to investigate the relative efficiency pattern of Jordanian banks during the period between 1998 and 2004.They used three inputs (number of employees, total assets and net operating expenses) and three outputs (net operating income, demand deposits and net direct credits).They found that an increase in bank efficiency in the entire period except in 2003 and 2004.Also they found that both assets utilization and the labour factor had an adverse effect on bank efficiency, especially in terms of number of employees.

Kuo *et al.* (2008) employed DEA to measure the efficiency of 49 banks in Taiwan during 1999-2003.They used credit risk, liquidity risk and interest rate risk as inputs while loan, discount interest income and investment income as outputs. They found that weighing interest rate risk was more advantageous than liquidity risk, or credit risk in order to maximize efficiency. Also they found that an increase in loan and discount interest income could improve efficiency more than an increase in investment income.

Mihir and Charles (2009) used DEA to investigate the technical efficiency of Indian banks by using five input variables (borrowing, deposits, fixed assets, net worth, and operating expenses) and four output variables (advances and loans,

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investments, net interest income, and non-interest income), and the efficiency scores were calculated for a sample of forty-nine major banks operating in India. The results of the study show that foreign banks were slightly more efficient than public and private banks, and that there was not much of a difference in the efficiency of public and private banks.

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Table (3-1)
Outputs and Inputs used in Related Literature Review in the Banking Sector.

Author (date)	Country	Inputs	Outputs	Result(s) of the study
English *et al.* (1993)	United states	* labor * Occupancy expenses * Interest bearing small deposits * Borrowing funds	* Real state loans * Commercial loans * Consumer loans * Investment in U.S securities	* The banks with greater assets were technically more efficient than those with relatively less assets.
Miller and Noulas (1996)	United states	* Total transactions deposits * Total non-transactions deposits. * Total interest expense * Total non-interest expense	*Commercial and industrial loans. *Consumer loans * Real estate loans * Investments *Total interest income * Total non-interest income	* The technical efficiency of 201 large sized banks operating in United States was inefficient.
Resti (1997)	Italy	* Labor *Capital	* loans * Deposits * Non- interest income	* There was a high variance in efficiency score in Italian banking sector.
Ayadi *et al.* (1998)	Nigeria	* Interest paid on deposits * Total expenses * Total deposits	* Total loans * Interest income * Non-interest income	* The banks existence for long period of time are relatively efficient than other banks.
Jackson and Fethi (2000)	Turkey	* Number of employees * Sum of non-labor expenses	* Loans * Demand deposits * Time deposits	* The larger and more profitability banks were more likely to operate at higher levels of technical efficiency.
Saha and Ravisanker (2000)	India	* Number of Branches * Number of employees * Establishment expenditure * Non-establishment expenditure	* Deposits * Advances * Investments * Spread * Total income * Interest income * Non-interest income * Working funds	* The public sector banks in general had improved their efficiency scores over the period 1992 to 1995.

Continued on next page

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Author (date)	Country	Inputs	Outputs	Result(s) of the study
Isik and Hassan (2000)	Turkey	* Labor * Capital * Loanable funds	* Short-term loans * Long-term loans * Risk adjusted Off-balance sheet items * Other earning assets	* The foreign owned banks performed better than the private domestic banks.
Sathy (2003)	India	* Deposits * staff number	* Interest expenses * Non-interest income	* Most of foreign owned banks were efficient. * The efficiency scores of private owned banks were lower as compared to public owned and foreign owned banks.
Das *et al.*(2004)	India	* Borrowing funds * Number of employees * Fixed assets * Equity	* Investments * Performing loan assets * Other non-interest free based incomes	* There were significant differences in terms of revenue and profit. * Bank size, ownership, and the fact of its being listed on the stock exchange had a positive impact on the average profit efficiency and to some extent revenue efficiency scores.
Kao and Liu (2004)	Taiwan	* Total deposits * Interest expenses * Non-interest expenses	* Total loans * Interest income * Non-interest income	* All the efficiency scores calculated from the data contained in the financial statements published afterwards fall within the corresponding predicted ranges of the efficiency scores calculated from financial forecasts.

Continued on next page

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Author (date)	Country	Inputs	Outputs	Result(s) of the study
Maghyereh (2004)	Jordan	* Number of employees * Value of fixed assets * Deposits	* Loans * Liquid assets * Investment * Other income	* The range of pure technical efficiency score of all banks in Jordan was 0.847 to 0.987 and for scale efficiency was from 0.903 to 0.999. * According to Tobit model analysis, there was a positive impact of size, profitability, market power of the bank and financial liberalization on the efficiency of commercial banks.
Salhieh and Abu-Doleh (2004)	Jordan	* Staff expenses * Fixed assets and premises * Loanable funds	* Credit facilities * Investment * interest income	* The improvement in efficiency was evident in banking industry in Jordan from 84.10% in 1994 to 94.52% in 2000.
Havrylchyk (2006)	Poland	* Capital * labor * Deposits	* Loans * Government bonds * Off-balance sheet items	* The foreign banks were significantly more cost efficient as compared to domestic banks. * According to Tobit model the ownership and assets of the banks had positive impact on the efficiency of bank.
Kirkwood and Nahm (2006)	Australia	* Number of full time employees * Interest bearing liabilities * Property, plant and equipment	* Interest bearing assets * Non-interest income	* There was an improvement in the efficiency of major banks in production banking services and profits. * Regional banks showed decline in the efficiency regarding the production of profits and little change regarding the production of banking services.

Continued on next page

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<table>
<tr><th>Author (date)</th><th>Country</th><th>Inputs</th><th>Outputs</th><th>Result(s) of the study</th></tr>
<tr><td>Mohd. et al. (2006)</td><td>Malaysia</td><td>* Total deposits
* Personal expenses
* Capital expenses</td><td>* loans
* Advances
* Capital market investments
* Money market investments</td><td>* Total factor productivity (TFP) had slightly increased for the whole banking industry in which efficiency change was found to be the productivity growth to Malaysia's banking industry.</td></tr>
<tr><td>Pasiouras (2006)</td><td>Greek</td><td>* Fixed assets
* Number of employees
* Loan loss provisions
* Customer deposits
* short-term funding</td><td>* Loans
* Off-balance items
* Other earning assets</td><td rowspan="2">* According to Tobit model there was significant positive impact of equity to assets, loans to assets and assets of the bank on the estimated efficiency of banks.</td></tr>
<tr><td>Pasiouras (2006)</td><td>Greek</td><td>* Employees' expenses.
* Other non-interest expenses.
* Loan loss provisions.</td><td>* Net interest income
* Net commission income
* Other operating income.</td></tr>
<tr><td>Bdour and Al-khoury (2008)</td><td>Jordan</td><td>number of employees, total assets and net operating expenses.</td><td>net operating income, demand deposits and net direct credits.</td><td>* There was an increase in bank efficiency in the entire period except in 2003 and 2004.
* assets utilization and the labour factor had an adverse effect on bank efficiency, especially in terms of number of employees.</td></tr>
<tr><td colspan="5">Continued on next page</td></tr>
</table>

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Author (date)	Country	Inputs	Outputs	Result(s) of the study
Kuo *et al.* (2008)	Taiwan	credit risk, liquidity risk and interest rate risk.	loan, discount interest income and investment income	* weighing interest rate risk was more advantageous than liquidity risk, or credit risk in order to maximize efficiency. * There was an increase in loan and discount interest income could improve efficiency more than an increase in investment income.
Mihir and Charles (2009)	India	* Borrowing * Deposits * Fixed assets * Net worth * Operating expenses	* Advances * Loans *Investments * Net interest income * Non-interest income	* The foreign banks were slightly more efficient than public and private banks. * There was not much of a difference in the efficiency of public and private banks.

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1.3 What Distinguishing this Study

As noticed from previous literature, the Data Envelopment Analysis (DEA) was used frequently to measure the relative efficiency of decision making units (DMUs).

This study differs from other studies discussed in the sense that it used risk ratios as input variables to measure the Jordanian banking efficiency. However, this study is consistent with most studies that used income from banks activities as output variables, such as Salhieh and Abu-Doleh (2004), and Bdour and Al-khoury (2008).

This study applied the DEA method to measure banking efficiency in Jordan. The variable outputs were measured as income from banks activities, and variable inputs were specified as the risks faced. This study specified direct credit facilities, net interest income and investment income as output variables, with credit risks, liquidity risks and interest rate risks as input variables. In other words, the study attempts to apply the DEA methods on the measurement of a bank's efficiency in Jordan to discuses the relationship between risk and return.

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Chapter Four: Methodology

4.1 Introduction

This chapter represents the mathematical presentation of Data Envelopment Analysis (DEA) model applied in this study, variables selection and their definition, and Tobit regression technique.

4.2 DEA model

This study aims to measure the performance efficiency of banks in Jordan using the published financial information in their annual reports for the period 2005 to 2009. In this study, one of the non-parametric technique called Data Envelopment Analysis (DEA) methodology was used to measure the relative efficiency of Jordanian banks.

In this study, DEA methodology, with intermediation approach and output maximization and with the CCR model with CRS approach, is used as a means to evaluate performance and to measure the relative technical efficiency in the Jordanian banking system.

Two models in common use to measure relative efficiency, one is so called CCR model, and the other is BCC model.

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4.2.1 CCR-Model

CCR-model is introduced by Charnes, Cooper and Rhodes (1978). This model measures the efficiency of each DMU which is obtained as a maximum of a ratio of total sum of weighted outputs to total sum of weighted inputs. Consequently, the efficiency can be defined as follow:

$$\textbf{\textit{Efficiency}} = \frac{\text{Weighted sum of outputs}}{\text{Weighted sum of inputs}} \qquad (1)$$

The weights for the ratio are determined by the restriction that the similar ratios for every DMU have to be less than or equal to unity, thus reducing multiple inputs and outputs to a single virtual input, (a weighted combination of all real inputs), and single virtual output, (a weighted combination of all real outputs), without requiring preassigned weights. Therefore, the efficiency score is a function of the weights of the "virtual" input-output combination. Suppose that there are n DMUs, each with m inputs and s outputs, relative efficiency score of a given DMU_0 is obtained by solving the following linear programming model (Chansarn, 2008).

$$Max\ h = \frac{\sum_{r=1}^{s} v_r y_{r0}}{\sum_{i=1}^{m} u_i x_{i0}} \qquad (2)$$

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Subject

$$\frac{\sum_{r=1}^{s} v_r y_{rj}}{\sum_{i=1}^{m} u_i x_{ij}} \leq 1; \; j = 1,2,\cdots,n$$

$$u_i \geq 0; \; i = 1,2,\cdots,m$$
$$v_r \geq 0; \; r = 1,2,\cdots,s$$

Where

h = efficiency score.
x = the input vector.
y = the output vector.
x_{ij} = the amount of input i utilized by the jth DMU.
y_{rj} = the amount of output r produced by the jth DMU.
u_i = weight given to input i
v_r = weight given to output r

Following the Charnes, Cooper and Rhods (1978) transformation, one can select a representative solution (u, v) for which

$$\sum_{i=1}^{m} u_i x_{i0} = 1 \qquad (3)$$

Hence, the denominator in the efficiency score h_0 shown above is set equal to one, the transformed linear programming model for DMU_0 can be written as follow,

$$Max \; z_0 = \sum_{r=1}^{s} v_r y_{r0} \qquad (4)$$

Subject to

$$\sum_{r=1}^{s} v_r y_{rj} - \sum_{i=1}^{m} u_i x_{ij} \leq 0; \; j = 1,2,\ldots\ldots,n$$

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$$\sum_{i=1}^{m} u_i x_{i0} = 1$$

$$u_i \geq 0;\ i = 1,2,\cdots,m$$
$$v_r \geq 0;\ r = 1,2,\ldots,s$$

The linear programming model shown above will be run n times in identifying the relative efficiency scores of all the DMUs. Each DMU selects input and output weights that maximize its efficiency score. Generally, a DMU is considered to be efficient if it obtain a score of 1.00 implying 100% efficiency; whereas a score of less than 1.00 implies that it is inefficient (Chansarn, 2008).

4.2.2 BCC- Model

In CCR model, the production function is assumed to be constant returns to scale (CRS). In some real cases, however, DMUs may produce under the circumstances of increasing returns to scale (IRS) or decreasing returns to scale (DRS). If DMU's production function bears the characteristic of variable returns to scale (VRS), its inefficiency may come from making improper use of scale. Banker, Charnes, and Cooper (1984) extended CCR model to BCC model which allow DMUs to be VRS. Once assuming DMU's Production function are VRS, it means the production is composed of possible CRS, IRS, and DRS production technology. In other words, increasing portions of input doesn't correspond to an increase of output (Chansarn, 2008).

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Applying BCC model, one could separate technical efficiency (acquired by CCR model) into pure technical efficiency (PTE), which indicates a proportional reduction in input usage if inputs are not wasted given the current production level, and scale efficiency (SE), refers to a proportional reduction in input usage if the DMU can attain the optimum production level, i.e.

Technical Efficiency (TE) = Pure Technical Efficiency (PTE) x Scale Efficiency (SE).

That is, the cause of technical inefficiency is either which resources do not being allocated well, or which DMU is in-economy of scale, or both (Chansarn, 2008).

The linear programming of BCC model is shown as equation (5)

$$Max \quad h = \sum_{r=1}^{s} v_r y_{r0} - v_0 \qquad (5)$$

$$S.T \quad \sum_{i=1}^{m} u_i x_{ij} = 1$$

$$\sum_{r=1}^{s} v_r y_{rj} - \sum_{i=1}^{m} u_i x_{ij} - v_0 \le 0, \qquad j = 1,2,\cdots,n$$

$$v_r, u_i \ge 0, \qquad r = 1,2,\cdots,s; \qquad i = 1,2,\cdots,m$$

4.3 Variables Selection and Definition

The kind of inputs and outputs, or their measurement units were determined by the chosen approach of the application (Mokhtar

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et al. 2006). For example, the production approach considers deposits as outputs since it sees banks as firms producing services for customers such as performing transactions and processing loans applications. However, the intermediation approach considers deposits as inputs since it views banks as the intermediate of funds between depositors and borrowers.

According to Kuo, Li and Wang (2008), this study selected six criteria of banking sector were divided into three inputs (credit risks, liquidity risks and interest rate risks) and three outputs (loans, discount interest income and investment income).

The input variables include:

1. Credit risks; represent the ratio of overdue loans to total loans. These risks result from failure or inability of the borrower to pay its obligations to bank.

$$\text{Credit risks} = \frac{\text{Overdue loans}}{\text{Total loans}}$$

2. Liquidity risks; represent the ratio of net loans to total assets. These risks result from the inability of the bank to transfer part of the assets into cash to meet any possible shortage in loans.

$$\text{Liquidity risks} = \frac{\text{Net loans}}{\text{Total assets}}$$

3. Interest rate risks; represent the ratio of uninsured deposits to total deposits. This ratio refers to a managing risk posed by

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changing interest rates which have a direct impact on the interest paid on uninsured deposits.

$$\text{Interest rate risks} = \frac{\text{Uninsured deposits}}{\text{Total deposits}}$$

The output variables include:

1. Direct credit facilities, which include a total amount of discounted bills, overdrafts, loans and credit cards that granted to individuals.
2. Net interest income that is the yearly income from interest on loans.
3. Investment income includes interest due from banks, bonds interest, and income from equity and bond investments.

The main purpose of banks is to pursuit maximum profits. However, high profits are accompanied by high risks. So this study chooses the outputs were measured by income from banks activities, and variable inputs were specified as the risks faced.

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4.4 Tobit Regression Technique

Tobit regression technique is a multiple linear regression which is used to study the relationship between the dependent variable and independent variables and then extract those variables that have a real relationship of the dependent variable and the exclusion of the others and then determine the relationship between the dependent variable and the variables affecting.

The principle method of Tobit regression technique simply and without going into details of the statistics is that we take into account all the variables and then begin to exclude the variable after the other and compare the value adjusted R-square with the previous value, the value was increased we keep this variable either the value was decreased, this means that this variable is not linked to variable under study.

Adjusted R-square is a number between zero and one, and if this number approached from the one which means that the type of regression analysis is very strong and is very close to accuracy.

P-value is the value of showing that was a significant variable was affected on the variable we are trying to study it. Where the variable is considered affected on the dependent variable until a value of P-value less than 0.05, but that if this value was increased more than 0.05, this variable should be removed as it is not impressive.

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Chapter Five: Data Analysis

5.1 Introduction

The purpose of this chapter is to provide a presentation of the Data Envelopment Analysis (DEA) technique used to achieve the objectives of this study. A program called Efficiency Measurement System (EMS); version 1.3 was used to obtain the efficiency scores of Jordanian Banks. Microsoft Office Excel 2007 was used to obtain the descriptive statistics. In additions, Minitab Program was used to obtain Tobit regression analysis.

This chapter contains eight sections. Sections one presents the introduction of this chapter, section two presents the statistical analysis, section three presents the comparative efficiency scores of Jordanian banks, section four presents the empirical analysis, section five presents the benchmarks for inefficient banks, section six presents the adjustment analysis of inefficient banks, section seven presents ranking banks performance, and finally, section eight presents the Tobit regression analysis.

5.2 Statistical Analysis

Descriptive statistics of intermediate inputs and outputs used in the DEA models will be presented in this section. Table (5-1) shows the descriptive statistics of the inputs used in this study.

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Table (5-1)

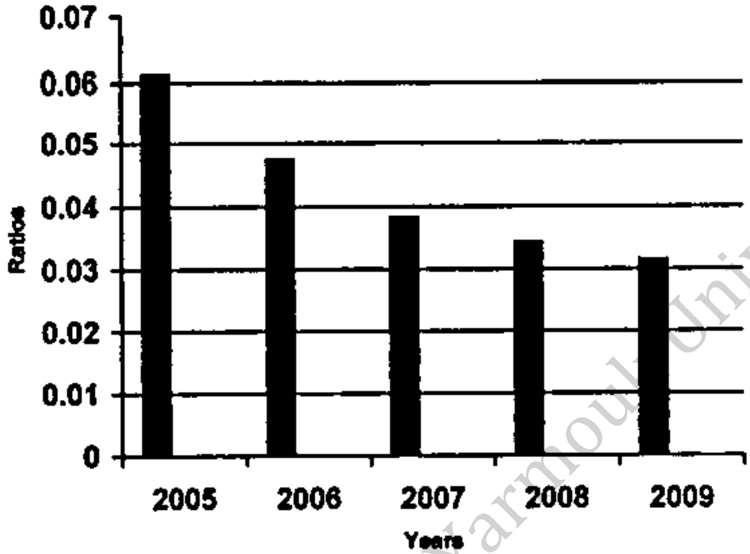
Descriptive Statistics of Inputs

		2005	2006	2007	2008	2009
Credit risks	Mean	0.0612	0.0475	0.0384	0.0343	0.0315
	S.D.	0.0473	0.0383	0.0256	0.0206	0.0119
	Max.	0.1616	0.1345	0.0949	0.0796	0.0624
	Min.	0.0117	0.0040	0.0046	0.0122	0.0281
Liquidity risks	Mean	0.4270	0.4598	0.4673	0.4481	0.4371
	S.D.	0.0927	0.0930	0.0762	0.0755	0.0530
	Max.	0.5512	0.5916	0.5980	0.6028	0.5302
	Min.	0.2641	0.3243	0.3742	0.4050	0.3504
Interest rate risks	Mean	0.1251	0.1480	0.1649	0.1355	0.1316
	S.D.	0.0879	0.1020	0.0901	0.0721	0.0807
	Max.	0.3675	0.3433	0.2831	0.2675	0.3074
	Min.	0.0154	0.0178	0.0279	0.0380	0.0424

Table (5-1) shows that the average credit risks have decreased during the period 2005 to 2009; this decrease might be that the Jordanian banks follow a clear policy in granting credit. This policy includes studying the quality of credit, level embedded risk and default probability. It also calls acquiring real estate, cash securities or other kinds of collateral. Furthermore, the policy also calls for any analysis of the financial strength of the borrower. Figure (5-1) shows the change in credit risks during the period of this study.

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Figure (5-1) Credit risks



It is noticeable from table (5-1) that an increase in average liquidity risks occurred between 2005 and 2007 and then followed by a decreases in 2008 and 2009. This increase in this ratio during 2005 to 2008 refers to increase the not loans that can be converted into cash from the total assets but in 2008 and 2009 the net loans decreased because the higher interest rate on loan during this period, so this ratio decreased. Figure (5-2) shows the change in liquidity risks during the period of this study.

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Figure (5-2) Liquidity risks

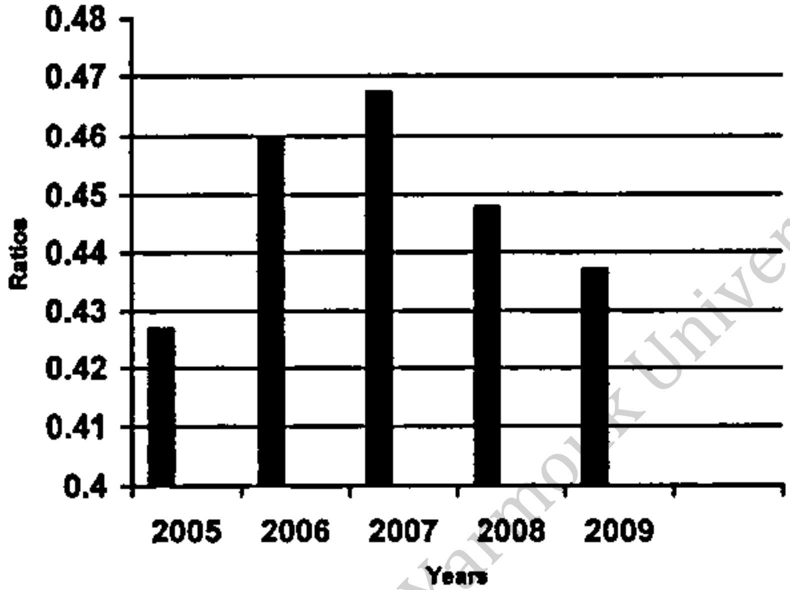
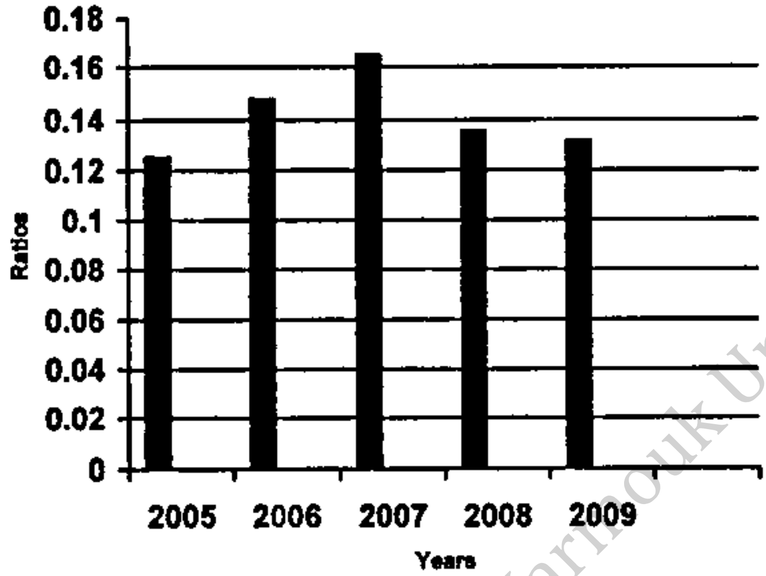


Table (5-1) shows that the average interest rate risks increased during the period 2005 to 2007, and then this average decreased during the period 2008 and 2009. This increased in this average might suggest that each bank includes a high level of other banks deposits as a percent of its total deposits during the period 2005 to 2007, but during the period 2008 and 2009 this ratio decreased that might be the Jordanian banks tend to deposit its excess cash in the Central Bank of Jordan with higher interest rate. Figure (5-3) shows the change in interest rate risks during the period of this study.

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Figure (5-3) Interest rate risks



The descriptive statistics of the outputs used in this study are presented in table (5-2) for the period from 2005 to 2009.

Table (5-2)
Descriptive Statistics of Outputs

		2005	2006	2007	2008	2009
Direct Credit Facilities	Mean	1,091,661,878	1,322,734,825	1,689,318,771	1,544,330,553	1,517,985,359
	S.D.	2,335,042,033	2,785,138,022	3,810,908,569	2,942,901,154	2,772,147,139
	Max.	8,786,470,810	10,492,972,850	14,266,093,190	11,142,473,000	10,520,933,000
	Min.	103,319,805	117,011,922	154,690,385	189,569,860	182,307,140
Net interest income	Mean	63,719,973	88,896,130	115,785,345	109,032,049	103,322,820
	S.D.	133,258,096	174,252,707	234,064,742	176,421,674	153,063,720
	Max.	501,780,430	659,837,080	884,168,680	675,392,000	586,919,000
	Min.	6,202,017	8,346,256	10,505,308	15,252,705	14,302,418
Investment income	Mean	90,425,459	110,676,720	118,386,669	74,231,308	65,908,808
	S.D.	183,547,050	271,614,625	276,343,806	143,334,317	117,710,615
	Max.	692,078,180	1,007,128,610	1,027,801,680	539,165,000	442,348,000
	Min.	2,951,446	3,695,761	4,496,794	4,776,055	6,298,983

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Table (5-2) shows that the average direct credit facilities increased during the period between 2005 to 2007 due to lower interest rates on loans during this period, which led to an increase in demand for credit by individuals and institutions. But in the years 2008 and 2009 the average direct credit facilities decreased due to the direction of commercial Jordanian banks to raise interest rates on credit facilities to compensate for the higher risk premium in this period because of the global financial crisis. Figure (5-4) shows the change in the direct credit facilities during the period of this study.

Figure (5-4) Direct credit facilities

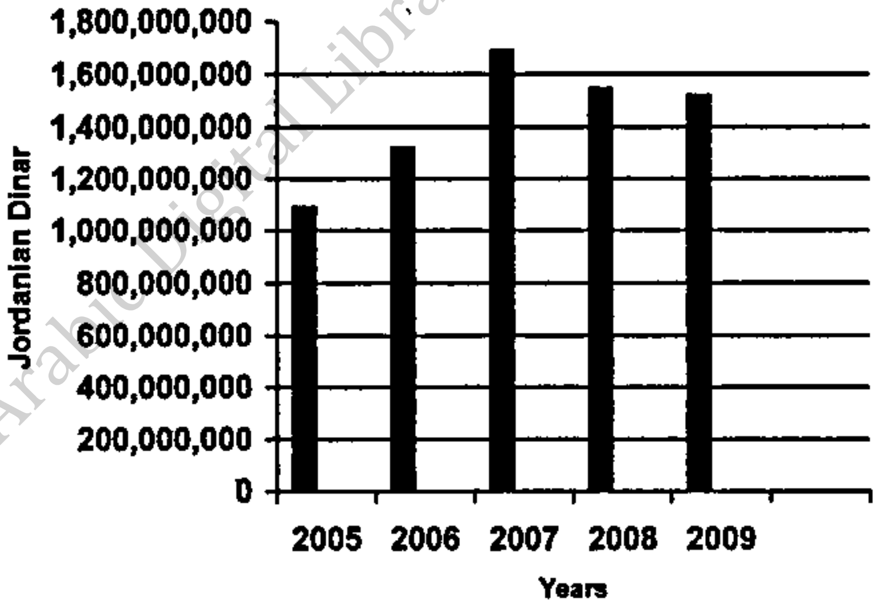
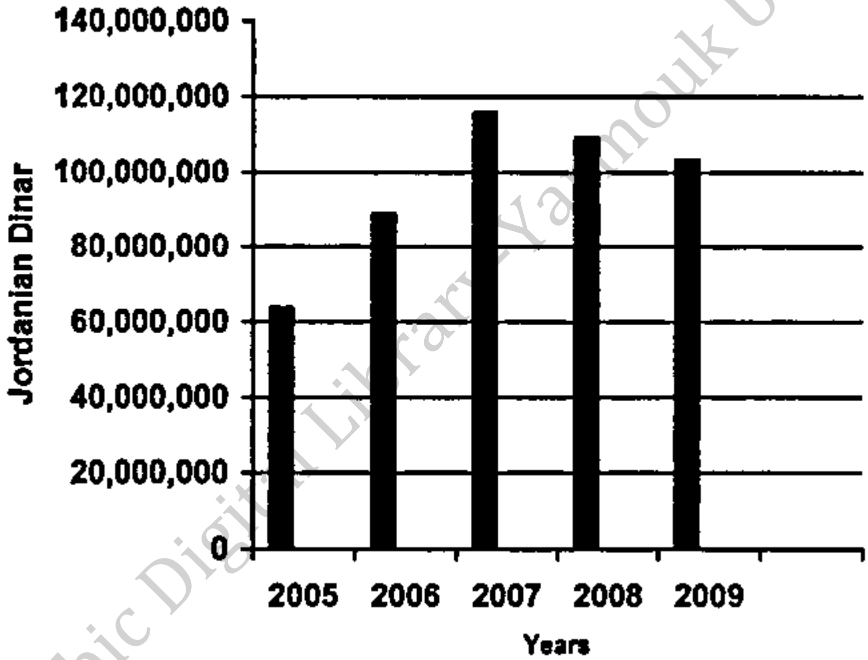


Table (5-2) shows that the average net interest income on credit facilities increased during the period 2005 toe 2007, because of the low interest rates on credit facilities which led to increase demand on loans which led to an increase in interest income on loans during this period. But in years 2008 and 2009 the average net

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interest income on credit facilities decreased because of the decrease of the loans granted to individuals and institutions due to high interest rates on loans during this period. Figure (5-5) shows the change in the net interest income during the period of this study.

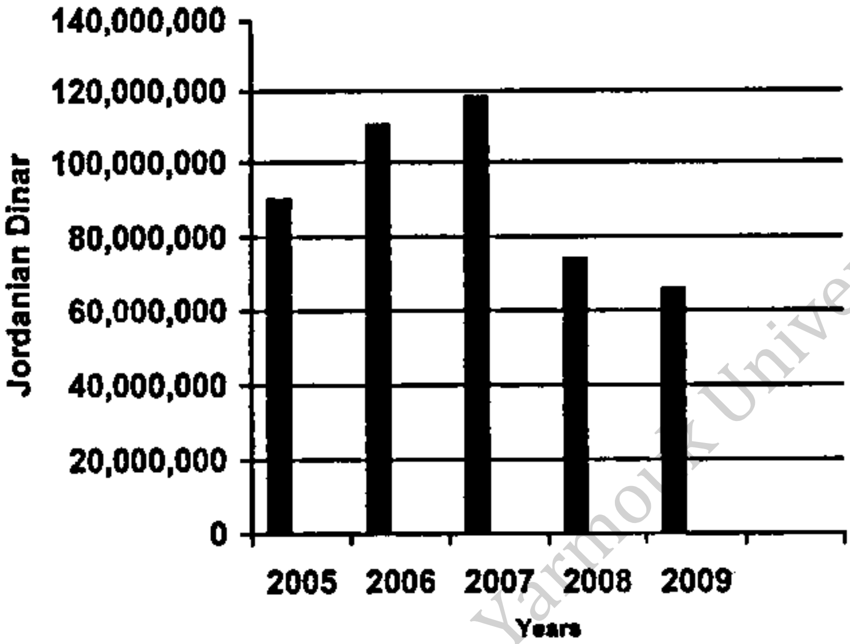
Figure (5-5) Net interest income



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Table (5-2) shows that the average investment income increased during the period 2005 to 2007, and then this average decreased in 2008 and 2009 due to losses resulting from investment activities such as decline in stocks and bonds prices in financial markets because of the global crisis. Figure (5-6) shows the change in the investment income during the period of this study.

Figure (5-6) Investment income



5.3 Comparative Technical Efficiency of Jordanian Banks

This section presents the comparative efficiency scores of Jordanian Banking Industry. The aim of this study is to use the published financial information to measure the performance of Jordanian banks by using a model called Data Envelopment Analysis (DEA) methodology with Charens Cooper Rhodes (CCR) model under the assumption of constant Return to Scale (CRS). This assumption is applied here that all DMUs must minimize the inputs they use to produce the most possible outputs.

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Table (5-3)

Comparative Technical Efficiency Scores of Jordanian Banks during the period 2005-2009

DMU	2005	2006	2007	2008	2009
Bank1	92.54%	93.74%	93.01%	92.02%	87.62%
Bank2	72.87%	74.38%	78.75%	76.02%	73.15%
Bank3	83.39%	89.12%	97.19%	86.94%	81.75%
Bank4	95.60%	80.81%	93.91%	85.92%	80.24%
Bank5	68.94%	73.56%	78.80%	73.62%	65.84%
Bank6	63.96%	75.99%	83.04%	80.06%	78.08%
Bank7	93.33%	100.00%	100.00%	81.46%	75.91%
Bank8	94.55%	90.30%	89.66%	82.74%	81.55%
Bank9	100.00%	100.00%	100.00%	100.00%	100.00%
Bank10	100.00%	90.66%	88.12%	85.63%	83.09%
Bank11	100.00%	80.17%	78.43%	76.01%	75.39%
Bank12	100.00%	100.00%	78.21%	66.16%	64.88%
Bank13	74.10%	91.68%	93.91%	80.36%	74.41%

Table (5-3) shows that the annual efficiency scores assuming CRS model during the period 2005 to 2009 using the CCR model. The results documented in this table identified the best practice banks (score=100%) and the relative inefficient banks (score < 100%).

Table (5-3) shows that the efficiency of the Jordanian banks increased during the period 2005 to 2007 and then this efficiency decreased in 2008 and 2009 due to the impact the global economic crisis which has effected negatively on the Jordanian banking sector.

It is noticeable from table (5-3) that bank 9 has still efficient during the period 2005 to 2009 with efficient score 100%, despite the emergence of the global economic crisis in 2008 and 2009,

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which indicates the effectiveness of the decision makers in this bank to face this crisis and still the best practice bank with the highest efficiency level during the period 2005 to 2009.

Table (5-3) shows that Bank 7 improves its efficiency score from 93.33% in 2005 to become efficient, with a score of 100%, in 2006 and 2007, this is an improvement insight for the decision makers involved, because it clearly demonstrates the effectiveness of any operational decisions made for this bank during this period. But the efficiency level for bank 7 decreased in 2008 and 2009 due to the impact the global economic crisis that has effected negatively on the Jordanian banks during this period.

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Table (5-4)

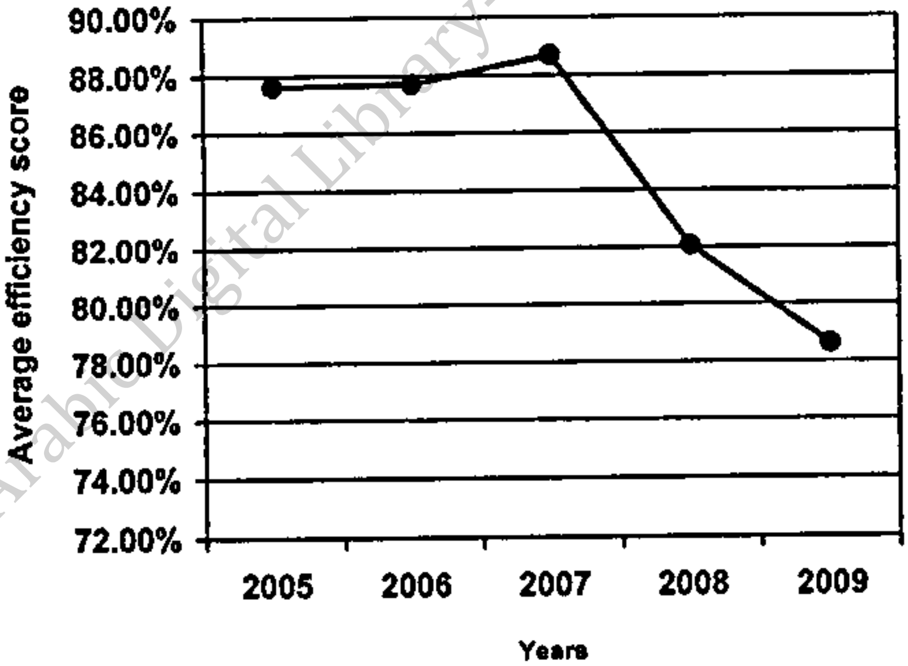
Descriptive of Efficiency Score

Average Technical Efficiency	87.64%	87.72%	88.69%	82.07%	78.61%
Standard Deviation	13.26%	9.76%	8.40%	8.55%	9.11%
Max.	100.00%	100.00%	100.00%	100.00%	100.00%
Min.	63.96%	73.56%	78.21%	66.16%	64.88%
Number of Efficient DMUs	4	3	2	1	1

Table (5-4) summarizes some fact that are drawn from table (5-3). As shown in table (5-4) there was a slight increase in average technical efficiency through 2005 to 2007 but in year 2008 and 2009

there was a sharp decrease in the average technical efficiency, the reason of this decrease might be explained by the global economic crisis that effected on the Jordanian banks during the period 2008 to 2009, which adversely affected Jordan's economy causing a major decline in income and high inflation that reflected negatively on Jordanian banks performance. Figure (5-7) shows the change in the average technical efficiency scores for the Jordanian banks during the period 2005 to 2009.

Figure (5-7) Average technical efficiency



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5.4 Empirical Analysis

This section presents the input and output weights that maximized the efficiency score of each bank. For example, the input and output weights that maximized the efficiency score of Bank 10 for 2009 are as follows:

Table (5-5)

Weight and Efficiency Score for Bank 10 in 2009

DMU	Efficiency score	Inputs	Weights	Outputs	Weights
Bank 10	95.09%	Credit risks	0.14	Loans	0.25
		Liquidity risks	0.66	Discount interest income	0.39
		Interest rate risks	0.20	Investment income	0.36

Table (5-5) shows that Bank 10 has used at least its inputs (credit risks, liquidity risks and interest rate risks) in order to produce the most loans, net interest income and investment income as output and these in turn has enabled this bank to attain its maximum efficiency. The efficiency score of 95.09% can be explained that Bank 10 should be able to support its activity levels with only 95.09% of its resources. In other words, Bank 10 should be able to reduce the consumption of all its inputs by 4.91% without reducing its outputs. Table (5-6) presents the input and output weights that maximized the efficiency score of each bank in year 2009.

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Table (5-6)

Weights and Efficiency Scores for the Year 2009

DMU	Score	Credit (I)(V)	Liquid (I)(V)	Inter (I)(V)	Dir. credit (O)(V)	Net Inter. (O)(V)	Inv (O)(V)
Bank1	92.02%	0.34	0.56	0.10	0.70	0.20	0.10
Bank2	73.15%	0.15	0.70	0.15	0.80	0.10	0.10
Bank3	81.75%	0.01	0.91	0.08	0.84	0.10	0.06
Bank4	85.24%	0.02	0.93	0.04	0.08	0.77	0.15
Bank5	72.84%	0.00	0.87	0.13	0.00	1.00	0.00
Bank6	78.08%	0.00	0.56	0.44	0.20	0.70	0.10
Bank7	71.91%	0.12	0.88	0.00	0.00	1.00	0.00
Bank8	81.55%	0.03	0.92	0.06	0.10	0.85	0.05
Bank9	100.00%	0.00	0.92	0.08	0.00	1.00	0.00
Bank10	95.09%	0.14	0.66	0.20	0.25	0.39	0.36
Bank11	77.39%	0.01	0.91	0.08	0.60	0.15	0.25
Bank12	64.88%	0.02	0.93	0.05	0.50	0.20	0.30
Bank13	74.41%	0.15	0.85	0.00	1.00	0.00	0.00

5.5 Benchmarks for Inefficient Banks

In this section, the study identifies benchmarks for the inefficient banks within the data set used in this study. The benchmarks analysis means that inefficient bank in a particular year could have efficiency reference subset banks which had compared with them. This type of analysis provides more complete information for decision makers about the best practices necessary to improve the performance of the inefficient banks (Salhieh and Abu-Doleh, 2004).

Table (5-7) provides benchmarks for inefficient banks for the period 2005 to 2009. For example. Banks 9, 10 and 11 are the reference set for bank 8 in 2009. The composite (best –practice) bank 8 in 2008 is formed from the weighted average of Bank 9, bank

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10 and bank 11. The comparative efficiency rating of 81.55% for bank 8 in 2009 indicates the extent to which the efficiency of bank 8 in 2009 is lacking in comparison to he efficiency of its reference subset banks.

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Table (5 -7)

Benchmarks for Inefficient Jordanian Banks

DMUs	2005	2006	2007	2008	2009
Bank1	B.9 , B.10 , B.11	B.9 , B.10	B.7	B.9	B.9 , B.10
Bank2	B.9 , B.10 , B.11	B.9 , B.10	B.9 , B.10	B.9 , B.10	B.9 , B.10
Bank3	B.9	B.9 , B.12	B.9 , B.12	B.9 , B.12	B.9
Bank4	B.9 , B.11	B.9 , B.11	B.9	B.9 , B.12	B.9 , B.10 , B.11
Bank5	B.9	B.7 , B.9	B.9	B.9	B.9
Bank6	B.9 , B.11	B.9 , B.10 , B.11	B.9 , B.10 , B.11	B.9	B.9 , B.12
Bank7	B.7 , B.9	____	____	B.7 , B.9	B.9 , B.10
Bank8	B.9 , B.10 , B.11	B.9 , B.10 , B.11	B.9 , B.10 , B11	B.9 , B.10 , B.11	B.9 , B.10 , B.11
Bank9	____	____	____	____	____
Bank10	____	B.9 , B.10	B.9 , B.10	B.9 , B.10	B.9 , B.10
Bank11	____	B.9 , B.10 , B.11	B.9 , B.10 , B.11	B.9 , B.10 , B.11	B.9 , B.11
Bank12	____	____	B.9 , B.10	B.9	B.9 , B.10 , B.11
Bank13	B.9	B.7 , B.9	B.7 , B.9	B.7 , B.9	B.9 , B.10

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5.6 Adjustment Analysis of Inefficient Banks

DEA is not only rate efficiency but also locates the sources of inefficiency and estimates the amounts of efficiency. The magnitude of inefficiency is given by the magnitude of excess resources used and/or deficient outputs produced by inefficient banks (Bdour and AL-khoury, 2008).Slack is the adjustment usually refers to excess utilization of inputs, are calculated by the actual inputs/outputs values of a given bank from the ideal values of the composite bank. Excess resource utilization and/or deficient output production must be eliminated before a given bank is said to be efficient relative to its composite reference set of banks.

Table (5-8) presents the potential increase in the production of outputs for the relative inefficient banks during the period 2005 to 2009. This table was illustrated under the banks maximization assumption. It is noticeable that all inefficient banks had a deficient produced of all outputs (loans, net interest income and investment income) compared to their reference set. For example, if Bank 2 in year 2009 was as efficient as its reference set banks, it could have increased its net interest income by 13%, investment income by 47%, but its direct credit facilities would have no effect on improving its efficiency in this year.

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Table (5-8)

Percentage Analysis of Output Variables for Inefficient Jordanian Banks during the Period 2005 - 2009

DMU	2005			2006			2007			2008			2009		
	Direct Credit.	Net Interest.	Inv.	Direct Credit.	Net Interest.	Inv.	Direct Credit.	Net Interest.	Inv.	Direct Credit.	Net Interest.	Inv.	Direct Credit.	Net Interest.	Inv.
Bank 1	8	0	3	32	13	0	29	26	0	0	6	7	0	1	53
Bank 2	0	33	10	0	45	9	0	38	0	0	10	17	0	13	47
Bank 3	0	5	63	31	0	73	56	0	26	46	0	98	0	0	61
Bank 4	0	8	21	0	12	24	2	0	25	31	0	74	16	0	83
Bank 5	0	40	9	0	9	51	6	0	36	0	2	101	31	0	147
Bank 6	0	68	39	0	18	146	0	0	105	7	0	143	25	0	117
Bank 7	0	48	8	0	0	0	0	0	0	4	0	18	24	0	83
Bank 8	11	0	8	22	0	47	30	0	71	23	0	93	14	0	101
Bank 9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bank 10	0	0	0	0	11	3	0	18	31	0	1	49	24	0	83
Bank 11	0	0	0	24	0	94	39	0	97	4	0	89	0	9	84
Bank 12	0	0	0	0	0	0	0	40	137	0	24	144	0	17	120
Bank 13	5	54	0	0	22	63	0	10	21	0	15	64	0	0	132

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5.7 Ranking Banks Performance

In order to rank the Jordanian Banks performance according to their efficiency scores, super efficiency was used. Super efficiency is a ranking model proposed by Andersen and Petersen (1993) (cited in Salhieh and Abu-Doleh, 2004). Super efficiency provides a means for ranking and discriminating among efficient banks to identify which of them is the most efficient. Ranking model allows the efficiency scores to arrive to value greater than 100% and the highest efficiency score will be the most efficient, but the lower efficiency score will be less efficient. Table (5-9) represents the ranking of Jordanian banks included in this study over the period 2005-2009.

Table (5-9) shows that there is no any bank that has the same ranking over the whole period of this period. It is clearly from table (5-9) that the best performance across all five years is Bank 9, which moved from rank 3 in 2005 and 2006 to a rank 1 in 2007, 2008 and 2009 this is clearly shows significant improvement in its performance. On other hand, Bank 12 dropped down from high rank of 2 in 2005 and 2006 to a rank 13 in 2007. 2008 and 2009, which shows a decline in its performance during this period.

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Table (5-9)

Jordanian Commercial Banks Ranking of its Efficiency during the Period (2005 – 2009)

Rank	2005		2006		2007		2008		2009	
	DMU	Efficiency	DMU	Efficiency	DMU	Efficiency	DMU	Efficiency	DMU	Efficiency
1	Bank 10	119.31%	Bank 7	172.51%	Bank 9	106.17%	Bank 9	103.74%	Bank 9	100.78%
2	Bank 12	116.02%	Bank 12	109.67%	Bank 7	103.33%	Bank 4	93.92%	Bank 10	95.09%
3	Bank 9	111.72%	Bank 9	101.20%	Bank 3	97.19%	Bank 1	93.47%	Bank 1	92.02%
4	Bank 11	110.86%	Bank 1	93.04%	Bank 13	93.91%	Bank 3	86.94%	Bank 4	85.24%
5	Bank 4	95.60%	Bank 10	92.66%	Bank 4	90.91%	Bank 10	85.63%	Bank 3	81.75%
6	Bank 8	94.55%	Bank 8	92.30%	Bank 8	89.66%	Bank 6	85.06%	Bank 8	81.55%
7	Bank 7	93.33%	Bank 11	92.17%	Bank 10	88.12%	Bank 8	82.74%	Bank 6	78.08%
8	Bank 1	92.54%	Bank 13	91.68%	Bank 1	87.61%	Bank 7	81.46%	Bank 11	77.39%
9	Bank 3	83.39%	Bank 3	89.12%	Bank 5	78.80%	Bank 13	80.36%	Bank 13	74.41%
10	Bank 13	74.10%	Bank 4	85.81%	Bank 2	78.75%	Bank 2	76.02%	Bank 2	73.15%
11	Bank 2	72.87%	Bank 5	75.56%	Bank 11	78.43%	Bank 11	76.01%	Bank 5	72.84%
12	Bank 5	86.94%	Bank 2	74.38%	Bank 6	64.04%	Bank 5	63.62%	Bank 7	71.91%
13	Bank 6	63.96%	Bank 6	63.99%	Bank 12	56.21%	Bank 12	58.16%	Bank 12	64.88%

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5.8 Tobit Regression Analysis

Tobit regression analysis was used in this study to discover to what extent that a certain input or output for a specific DMU affected the efficiency score of that DMU. Tobit regression analysis was conducted for the Jordanian banks efficiency scores obtained from CCR model. Table (5-10) shows the results of Tobit regression analysis on the study sample for the period from 2005 through 2009.

The regression equation is:

$$\text{Eff.} = 0.3692 - 0.4832\ \text{Credit.} - 1.3178\ \text{Liquid.} - 0.0991\ \text{Inter.} + 0.1872\ \text{Dir.credit.} - 0.1085\ \text{Net interest.} - 0.0447\ \text{Inv.}$$

Table (5-10)
Tobit Regression Analysis on the Study Sample for the Period from 2005 to 2009

Dependent Variable : Technical Efficiency				
Independent Variable	**Coefficient Estimation**	**Std. Error**	**T-Statistic**	**P-value**
Credit risks	− 0.4832	0.2040	− 2.37	0.021
Liquidity risks	− 1.3178	0.1186	− 11.11	0.000
Interest rate risks	− 0.0991	0.0670	− 1.48	0.143
Direct credit facilities	0.1872	0.0473	3.96	0.000
Net interest income	− 0.1085	0.0370	− 2.93	0.005
Investment income	− 0.0447	0.0204	− 2.19	0.032
Constant	0.3692	0.1743	2.12	0.038

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We can deduce from table (5-10) that the adjusted R-square had been 80.4% and this means that the regression analysis to measure the efficiency of Jordanian banks is very strong.

Also, table (5-10) indicated that the interest rate risks variable is not statistically significant (P-value = 0.143), so this variable is not associated with Jordanian banks efficiency. In contrary credit risks and liquidity risks variables are significant variable with P-value = 0.021 and P-value = 0.000 respectively. Hence, these two variables are associated with Jordanian banks efficiency.

In addition, table (5-10) indicates that all of the outputs are statistically significant and these variables are associated with Jordanian banks efficiency.

Table (5-10) shows that loans variable are the main source of Jordanian bank efficiency according to outputs with coefficient estimations 0.1872 and P-value is less than zero.

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Chapter Six: Conclusions and Recommendations

6.1 Introduction

This chapter represents the main conclusion of this study. In addition, it represents some recommendations for future researches in study the efficiency of banks.

6.2 Conclusions

The technical performance efficiency of Jordanian banks was measured by using Data Envelopment Analysis (DEA) methodology with Charnes Cooper Rhodes (CCR) model under the assumption of Constant Return to Scale (CRS) with applied output variable maximization.

A summary of the main conclusions of this study are on the following points:

1. Descriptive statistics of inputs indicates that all risk ratios during the study period were changed from increase to decrease gradually as it is clearly in the credit risks, and this is a good indicator of the ability of Jordanian banks in managing risks .
2. Descriptive statistics of outputs indicates that it is a clear reduction in all output variables and this shows clearly in the

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net interest income and investment, which proves that Jordanian banks affected by the global economic crisis in 2008 and 2009.

3. Jordanian banks have an decrease in the performance efficiency trend measured by average technical efficiency during the period 2005 to 2007, but in 2008 and 2009 there was a decrease in the efficiency of Jordanian banks because the affected of the global economic crisis.

4. Although there are inefficient banks in Jordan over the period of this study but the majority of Jordanian banks centered in its efficiency score between range 90% to 100%, and this is a good indicator of the efficiency of the Jordanian banks.

5. Adjustment analysis suggests that most inefficient banks in Jordan can improve their efficiency scores by making some adjustment to its output variables, under the outputs maximization assumption.

6. Under ranking model supper efficiency analysis was used which indicated that Jordanian banks had a fluctuated performance and there was not any bank had the same ranking over the period of this study.

7. Tobit regression analysis indicates that interest rate risks variable is not associated with Jordanian banks efficiency but the other input variables, credit risks and liquidity risks, are associated with Jordanian banks efficiency, this differs from the results of Kuo *et al.*(2008) that found interest rate risks had

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the highest influence on bank efficiency, but this study consistent with the results of Kuo *et al.*(2008)about credit risks and liquidity risks had influence on the efficiency of banks. In other hand, this analysis indicates that all outputs variables are associated with Jordanian banks efficiency and this result consistent with the results of Kuo *et al.*(2008), that found the loan, net interest income and investment income had influence on the efficiency of banks.

6.2 Recommendations

Based on analysis in this study, the researcher recommends the following:

1. Managers of efficient banks in Jordan should plan in order to improve their organizations and maintain its efficiency level in the Jordanian banking sector.
2. Managers of inefficient banks should have at their disposal effective techniques to evaluate efficiency throughout their organizations and to guide them further on how to improve it.
3. Future researches in the estimation of the efficiency of commercial banks should consider other factors that affecting the efficiency of their commercial banks to see their effect on the commercial banks.

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Appendices

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Appendix A: Study Sample, Inputs and Outputs

Year 2005

DMU	Inputs			Outputs		
	Credit risks	Liquidity risks	Interest rate risks	Direct credit facilities	Net interest income	Investment income
Bank1	0.0364	0.4266	0.1528	8,786,470,810	501,780,430	692,078,180
Bank2	0.0404	0.4512	0.1576	201,800,587	12,499,221	21,178,988
Bank3	0.0478	0.4477	0.0503	563,830,309	41,447,089	29,024,542
Bank4	0.0838	0.3588	0.0814	496,363,243	31,644,075	45,950,144
Bank5	0.0228	0.5512	0.1087	396,607,494	25,331,489	29,211,012
Bank6	0.0971	0.5445	0.0806	247,630,539	11,125,816	18,205,870
Bank7	0.0117	0.4892	0.1254	698,314,415	38,859,888	38,039,646
Bank8	0.1444	0.3345	0.1704	703,045,028	38,218,740	95,774,831
Bank9	0.0277	0.3950	0.0384	1,315,237,415	82,907,498	117,454,072
Bank10	0.0454	0.2641	0.3675	135,882,513	7,072,732	18,859,121
Bank11	0.1616	0.2926	0.1237	210,670,223	11,804,014	34,358,481
Bank12	0.0531	0.5037	0.0154	103,319,805	6,202,017	2,951,446
Bank13	0.0230	0.4921	0.1547	332,432,029	19,466,644	32,444,633

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Cont. Appendix A: Year 2006

DMU	Inputs			Outputs		
	Credit risks	Liquidity risks	Interest rate risks	Direct credit facilities	Net interest income	Investment income
Bank1	0.0296	0.4363	0.1537	10,492,972,850	659,837,080	1,007,128,610
Bank2	0.0256	0.4647	0.2795	254,509,778	15,438,580	24,968,377
Bank3	0.0431	0.4839	0.0369	703,076,943	56,948,355	29,155,352
Bank4	0.0766	0.4270	0.0571	560,338,442	41,021,379	42,665,518
Bank5	0.0159	0.5719	0.1205	500,108,278	42,933,495	19,061,974
Bank6	0.0705	0.5311	0.1308	320,406,486	22,375,854	8,400,212
Bank7	0.0040	0.5814	0.1045	963,702,017	73,927,451	42,294,020
Bank8	0.1019	0.3571	0.1793	739,070,006	49,732,768	66,947,720
Bank9	0.0242	0.3881	0.0487	1,645,630,508	120,589,024	138,328,628
Bank10	0.0367	0.3243	0.3433	188,477,661	11,404,137	22,606,104
Bank11	0.1345	0.3303	0.1706	264,915,377	18,863,246	18,609,245
Bank12	0.0435	0.5916	0.0178	117,011,922	8,346,256	3,695,761
Bank13	0.0114	0.4900	0.2807	445,332,454	34,232,061	14,935,845

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Cont. Appendix A: Year 2007

DMU	Inputs			Outputs		
	Credit risks	Liquidity risks	Interest rate risks	Direct credit facilities	Net interest income	Investment income
Bank1	0.0226	0.5083	0.1832	14,266,093,190	884,168,680	1,027,801,680
Bank2	0.0231	0.4443	0.1697	281,133,281	18,648,575	29,752,791
Bank3	0.0488	0.5071	0.0279	787,368,111	67,970,975	38,784,032
Bank4	0.0713	0.4090	0.0492	595,210,990	48,878,495	45,102,982
Bank5	0.0270	0.5294	0.0644	514,727,323	47,124,066	28,066,990
Bank6	0.0498	0.5370	0.1303	328,005,946	28,295,772	12,465,878
Bank7	0.0046	0.5599	0.2145	1,135,040,795	96,139,376	54,508,206
Bank8	0.0949	0.3742	0.1899	865,608,220	62,664,563	63,581,751
Bank9	0.0198	0.3857	0.0618	1,995,108,369	153,158,350	168,338,102
Bank10	0.0283	0.3743	0.2831	249,300,843	17,189,332	20,595,926
Bank11	0.0612	0.4114	0.2491	313,265,684	29,373,880	19,990,458
Bank12	0.0334	0.5980	0.2803	154,690,385	10,505,308	4,496,794
Bank13	0.0143	0.4357	0.2398	475,590,882	41,092,118	25,541,106

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Cont. Appendix A: Year 2008

DMU	Inputs			Outputs		
	Credit risks	Liquidity risks	Interest rate risks	Direct credit facilities	Net interest income	Investment income
Bank1	0.0195	0.4764	0.1950	11,142,473,000	675,392,000	539,165,000
Bank2	0.0258	0.4553	0.1846	280,508,227	23,603,182	25,229,926
Bank3	0.0479	0.4902	0.0402	876,691,531	80,520,660	34,935,028
Bank4	0.0607	0.4328	0.0380	687,475,930	59,197,234	35,312,100
Bank5	0.0307	0.6028	0.0883	616,285,776	52,977,927	21,615,005
Bank6	0.0293	0.5864	0.0466	394,828,778	32,785,164	10,150,987
Bank7	0.0122	0.5999	0.1983	1,253,362,329	109,404,966	57,440,906
Bank8	0.0796	0.4224	0.1637	1,009,635,449	76,735,985	51,715,841
Bank9	0.0153	0.4312	0.0754	2,393,019,514	188,433,010	129,513,581
Bank10	0.0230	0.4050	0.2675	293,231,020	26,979,546	19,217,337
Bank11	0.0561	0.4445	0.1332	324,109,733	27,235,808	15,537,345
Bank12	0.0295	0.5976	0.1723	189,569,860	15,252,705	4,776,055
Bank13	0.0159	0.5302	0.1583	615,106,036	48,898,451	20,397,898

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Cont. Appendix A: Year 2009

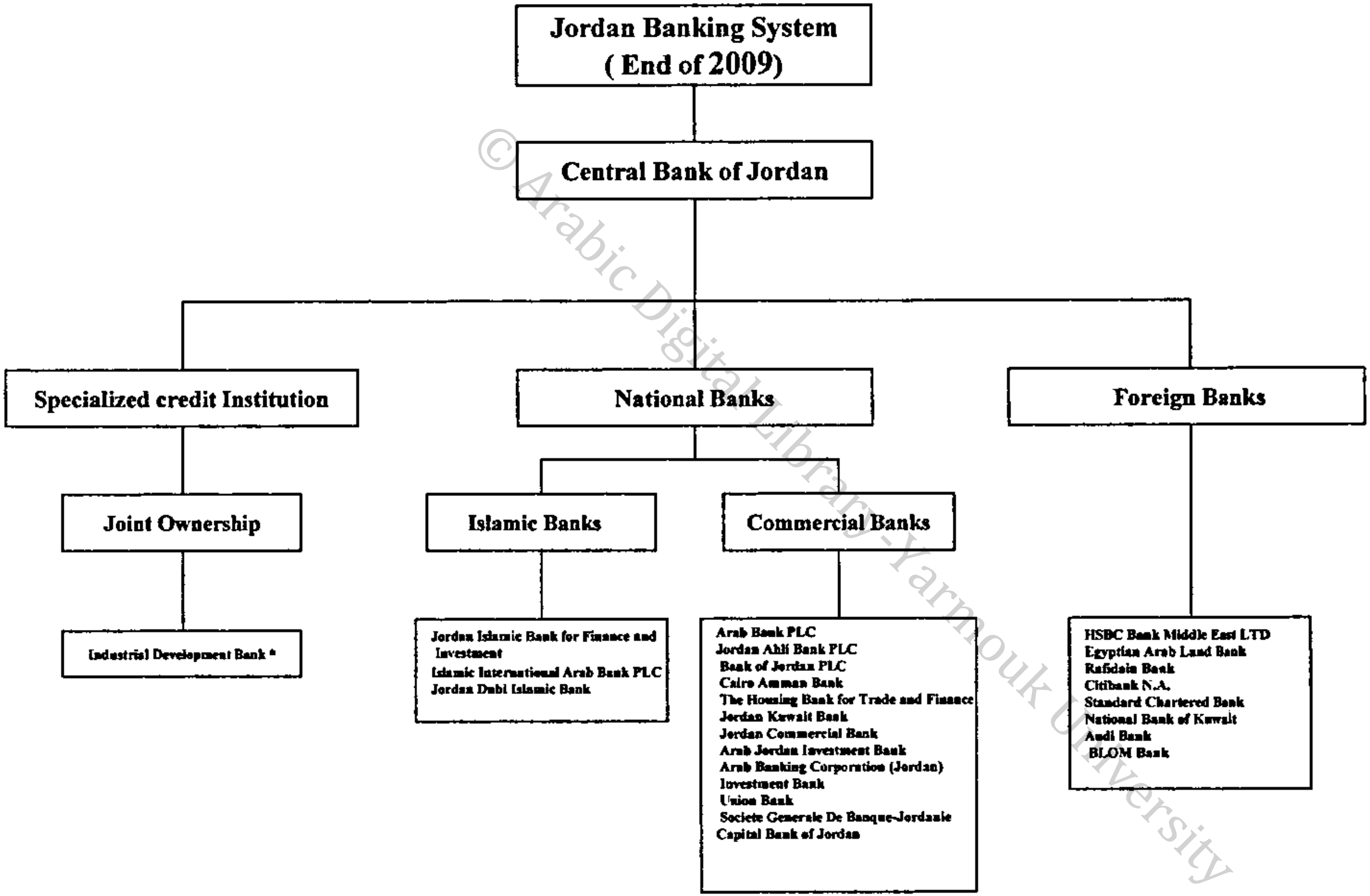
DMU	Inputs			Outputs		
	Credit risks	Liquidity risks	Interest rate risks	Direct credit facilities	Net interest income	Investment income
Bank1	0.0281	0.4389	0.1993	10,520,933,000	586,919,000	442,348,000
Bank2	0.0305	0.4654	0.1683	299,882,455	22,805,192	20,216,228
Bank3	0.0486	0.4532	0.0710	917,407,326	78,608,044	32,961,292
Bank4	0.0544	0.4178	0.1171	784,546,475	65,872,180	40,229,489
Bank5	0.0620	0.5302	0.0519	615,642,512	56,129,357	18,120,869
Bank6	0.0416	0.5171	0.0424	355,818,415	30,810,214	10,965,195
Bank7	0.0344	0.5092	0.2060	1,130,699,680	100,646,702	56,758,068
Bank8	0.0624	0.4347	0.1590	1,089,786,165	80,547,923	45,377,895
Bank9	0.0403	0.3890	0.0603	2,493,336,380	197,656,277	131,417,689
Bank10	0.0285	0.3504	0.3074	306,178,560	28,973,801	18,315,749
Bank11	0.0411	0.4494	0.0805	315,277,141	26,017,415	14,733,910
Bank12	0.0346	0.5135	0.1445	182,307,140	14,302,418	6,298,983
Bank13	0.0332	0.4733	0.2334	721,994,413	53,908,142	19,071,143

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Appendix B: List of the Population of the study

No. of the Bank	The Name of the Bank
Bank 1	Arab Bank PLC.
Bank 2	Arab Banking Corporation (Jordan).
Bank 3	Bank of Jordan.
Bank 4	Cairo Amman Bank.
Bank 5	Capital Bank.
Bank 6	Jordan Commercial Bank.
Bank 7	Jordan Kuwait Bank.
Bank 8	Jordan Ahli Bank.
Bank 9	The Housing Bank for Trade and Finance.
Bank 10	Arab Jordan Investment Bank.
Bank 11	Jordan Investment and Finance Bank.
Bank 12	Societe General Bank - Jordan.
Bank 13	Union Bank.

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* The Industrial Development Bank (IDB) has been abolished as a specialized credit institution by the Law of Abolishing IDB Law for 2008 No. 26/2008, as a first step towards obtaining a license to operate as an Islamic bank under the name of Jordan Dubai Islamic Bank which started its work on 3/1/2010.

"دراسة كفاءة البنوك: دراسة تطبيقية على البنوك التجارية الأردنية باستخدام طريقة تحليل تغليف البيانات خلال الفترة 2005-2009"

اعداد الطالب: منير زكارنه
اشراف الدكتورة عبير الخوري

ملخص الدراسة

تهدف هذه الدراسة الى قياس كفاءة اداء البنوك الأردنية للفترة من 2005 الى 2009 عن طريق استخدام طريقة تحليل تغليف البيانات. على وجه الخصوص، تم استخدام نموذج (CCR) مع نموذج معدل العائد الثابت (CRS) تحت فرضية تعظيم المخرجات حسب اسلوب الوسيط بين المدخلات و المخرجات للعملية المصرفية. استخدم في تحليل هذه الدراسة ستة معايير من القطاع المصرفي قسمت الى ثلاثة مدخلات (مخاطر الائتمان و مخاطر السيولة و مخاطر اسعار الفائدة) و ثلاثة مخرجات (القروض و خصم ايرادات الفوائد و ايرادات الاستثمار). تم استخدام الاسلوب التنظيمي لمعرفة ترتيب البنوك الأردنية حسب كفائتها، كما استخدم تحليل توبت لمعرفة الى اي مدى تؤثر المدخلات و المخرجات على درجة الكفاءة. اظهرت نتائج هذه الدراسة ان هناك عدد من البنوك الأردنية قد حققت معيار الكفاءة خلال فترة هذه الدراسة الا في العام 2008 بسبب الأزمة الاقتصادية العالمية التي اثرت على القطاع المصرفي في هذا العام. كما اشار تحليل توبت ان مخاطر اسعار الفائدة لم تؤثر على درجة الكفاءة للبنوك الأردنية، و لكن على الجانب الأخر، ان جميع المخرجات كان لها تأثير على كفاءة البنوك الأردنية.

المصطلحات الأساسية: الكفاءة، البنوك الأردينة، تحليل تغليف البيانات.

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